PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:	WO 94/09939
B23K 11/30, B23Q 15/28	A1	(43) International Publication Date:	11 May 1994 (11.05.94)

(21) International Application Number: PCT/SE92/00764

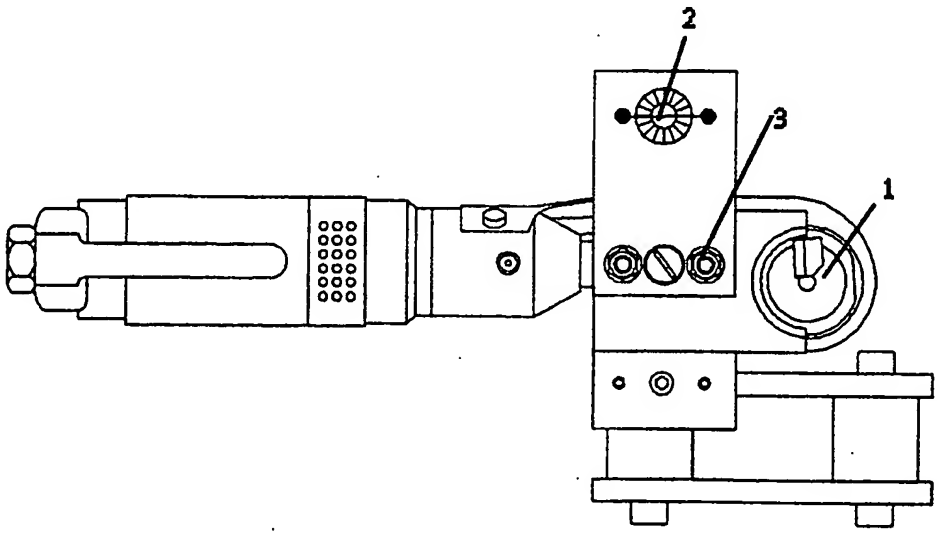
(22) International Filing Date: 5 November 1992 (05.11.92)

(71)(72) Applicant and Inventor: ARONSSON, Joachim [SE/SE]; Hamnvägen 42, S-430 91 Hönö (SE).

(81) Designated States: AU, BG, BR, CA, CS, FI, HU, JP, KP, KR, PL, RO, RU, UA, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE).

Published
With international search report.

(54) Title: A METHOD FOR AUTOMATIC PROGRAM COMPENSATION OF ELECTRODE WEAR



(57) Abstract

This innovation relates to a method to decrease the weight and size of the welding gun as well as the transformer for the current supply by substituting the mechanical system for compensating the electrode wear (or manufacturing tolerances) by a system for measuring the electrode tip and using this measure for adjusting the position of the gun at welding. It even includes a software function to move the fixed tip of the gun towards the sheet at the same time as the gun close to avoid interference between the gun and the sheet when the gun moves between the positions.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgystan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo			SE	Sweden
CH	Switzerland	KR	Republic of Korea	SI	Slovenia
CI	Côte d'Ivoire	KZ	Kazakhstan	SK	Slovakia
CM	Cameroon	LI	Liechtenstein	SN	Senegal
CN	China	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
CZ	Czech Republic	LV	Latvia	TJ	Tajikistan
DE	Germany	MC	Monaco	TT	Trinidad and Tobago
DK	Denmark	MD	Republic of Moldova	UA	Ukraine
ES	Spain	MG	Madagascar	US	United States of America
FI	Finland	ML	Mali	UZ	Uzbekistan
FR	France	MN	Mongolia	VN	Viet Nam
GA	Gabon				

A method for automatic program compensation of electrode wear.

Technical field

This innovation relates to a method to adjust a program for a spotwelding robot to compensate for tolerance and wear of the electrode tip.

This innovation even relates to a method to decrease the weight of the welding gun and by that the demand upon the robot.

This innovation even relates to a method to decrease the size and weight of the welding transformer and by that the the demand upon the robot as well as electric supply.

This innovation even relates to a method to decrease the size of the welding gun and by that the demand upon the access in the welding area.

Backoround art.

During the last 20 years production of spotwelds, mainly in car industries, has been performed by industrial programmable robots. Such a robot keeps a welding gun in a programmed position, the gun close with a force of 200-300 kN, and a current of about 10 kA is sent over the tips of the gun. By the time the tips of the guns are wearned down, up to 8 mm before they are exchanged.

The robot keeps the gun in programmed position independent of the wear of the tips. If the gun is stiff mounted toward the robot the wear of the electrodes will move the sheet to be welded to a wrong position or the force will be used to move the robot to the welding position.

Beside the wear, the manufacturing tolerances of new tips gives the same problem.

To avoid this problem, the gun has been mounted in a way it mecanicly can compensate for the wear. This has had different name, equalizing is one common used. The methods have been different such as the gun can rotate around an axe only when the gun is closed, a cylinder moves the gun in a linear movement until one tip reach the sheet etc. Such mecanical units increase by itself the weight and the size of the gun but also the current feed has the same influence because of the need of extra flexible current feed caused by the mecanical equalizing.

By this innovation the gun weight and sizecan be decreased as well as the current losses caused by the extra flexible current feed. The current saving also decrease the weight of the

transformer, normally carried by the robot, thus decreasing the demand upon the robot.

Simultaneously the software in the robots has been developed. Nowadays many robots offer a function for adjusting all programmed position along a line defined by two points in the space according to some input. This is a function developed for arcwelding robots where the distance to the sheet can be adjusted depending of the current in the arc.

Disclosure of the innovation.

This innovation uses the system developed for arcwelding to be used for compensating for the wear of the electrode tip.

The method uses a situation where the robot has a suitable position for measuring the tips. One such position can be just after tipdressing. Because of the wear the electrode needs tipdress with some interval. After this it is very suitable to adjust the programed positions.

The measurement can be done in different ways. One such is to let the gun close over a surface which can move in a direction perpendicular to the surface and with a unit to measure the position of the surface after the gun has closed. The measure sends information to the robot of where the surface are and this information is used to adjust the programmed positions to fit the actual electrode wear.

Only the adjustment of the positions is not enough for getting a good function. The robot move between the spot positions in a way it should touch the sheet because of the mechanical hysteria in the system. Of that reason the robot controller must have an added function where the electrode, that is not moving at gun close, can be programmed e.g. 5 mm from the surface. The robot shall each time it send a signal for gun closing even move the gun this 5 mm toward the surface. Such function is not known to exist for the moment but is possible to add to the functions of a modern controller.

Brief description of the drawing.

Fig 1 show how a measuring plate can be arranged. This is mounted upon an often used unit for automatic tipdressing (1). The measure surface (2) is mounted with the tipdresser upon a slide so it can move perpendicular to the shown plane. In the slide (3) the measure unit is mounted.

Claims

1. A method for automatic program compensating of electrode wear at automatic spotwelding c h a r a c t e r i z e d by a unit to with the gun is moved with some interval upon which is a device for measuring the position of the tip and by sending this information to the automatic unit adjusting the welding positions to this measurement.

2. A software program in an automatic spotwelding device controller according to claim 1 c h a r a c t e r i z e d by a move of the fixed electrode tip toward the sheet at the same time as the controller send the signal to the welding gun to close.

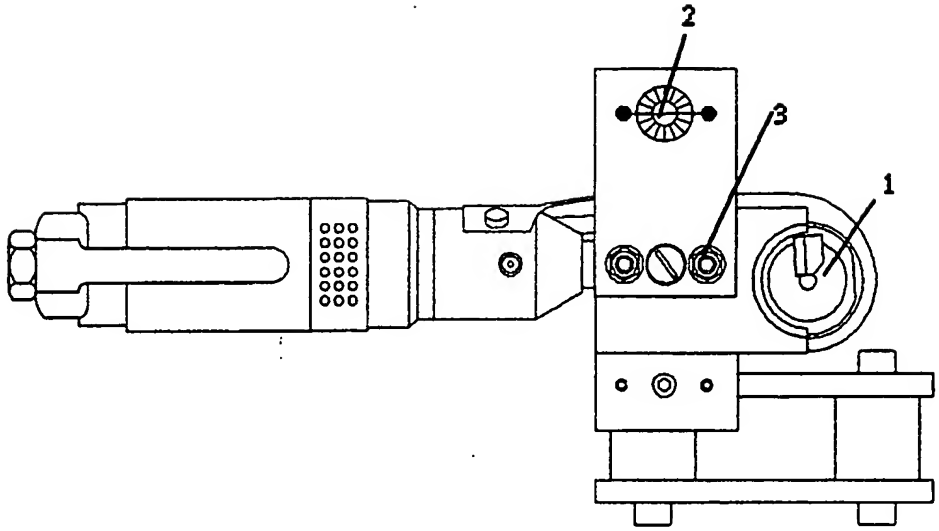


Fig 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 92/00764

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: B23K 11/30, B23Q 15/28
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: B23K, B23Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	INTERNATIONAL ENCYCLOPEDIA OF ROBOTICS: APPLICATIONS AND AUTOMATION, RICHARD C. DORF,1988, Tool/Media Wear Compensation, Page 528 and Structure and Composition of a Robotic Spot Welder, Page 1971-1974 especially Page 1974	1-2
X	US, A, 4999475 (YASUGE), 12 March 1991 (12.03.91)	1-2
X	US, A, 4694135 (NAGEL ET AL), 15 Sept 1987 (15.09.87), column 2, line 31 - line 36; column 3, line 33 - line 45	1-2

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 July 1993	27 -07- 1993
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Anders Axberger Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/07/93

International application No.
PCT/SE 92/00764

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4999475	12/03/91	DE-A,C- 4011075	11/10/90
		GB-A,B- 2230221	17/10/90
		JP-A- 2218344	31/08/90
US-A- 4694135	15/09/87	NONE	